

PROCEEDINGS
OF THE
CALIFORNIA ACADEMY OF SCIENCES
FOURTH SERIES

VOL. I, pp. 375-404

JANUARY 19, 1912

EXPEDITION OF THE CALIFORNIA ACADEMY OF
SCIENCES TO THE GALAPAGOS
ISLANDS, 1905-1906

V.

NOTES ON THE BOTANY OF COCOS ISLAND

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During the autumn of 1905, while acting as Botanist of the scientific expedition sent to the Galapagos Islands by the California Academy of Sciences, our party stopped at Cocos Island from September 3rd to 13th inclusive, during which time a considerable collection of plants was made.

Owing to the fact that Dr. B. L. Robinson of the Gray Herbarium, and Professor H. Pittier of the United States Department of Agriculture, have a catalogue of the plants of this island in preparation, in which all of the scattered references to its flora will be brought together, the present paper will deal mainly with the collection of plants and notes made by the author, so as not to infringe upon the work already done by these gentlemen.

The collection was identified at the Gray Herbarium of Harvard University some three years ago, but owing to the more pressing need of getting the results of the work done in the Galapagos Islands ready for publication, the author has

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not been able to take up the less important results of the expedition until the present time. The work of identification was greatly facilitated through the kindness of Dr. Robinson in allowing me to use the list of plants already compiled by him. I wish here to express my thanks to Dr. Robinson for this, as well as for his kindness in allowing me to publish his description of *Cecropia Pittieri*, a new species of this genus which occurs abundantly on this island. I wish also to acknowledge my indebtedness to Dr. W. G. Farlow for identification of the mosses; to Professor M. L. Fernald for much assistance; to Miss Mary A. Day, Librarian of the Gray Herbarium, for help in looking up the literature in connection with the subject; and to Mr. H. H. Bartlett of the United States Department of Agriculture, for identifying the specimens of *Hypolytrum nicaraguense*. The photographs were made by Messrs. R. H. Beck and E. W. Gifford, members of the expedition.

Cocos is a small island which lies in longitude $86^{\circ} 59' 17''$ W., latitude $5^{\circ} 32' 57''$ N., and is about 300 miles distant from Costa Rica, to which country the island belongs. According to the chart issued by the Hydrographic Office, it is about $3\frac{1}{2}$ miles long in a north and south direction, $3\frac{3}{8}$ miles broad east and west, and rises to a height of 2788 feet. There are several small islets a short distance off shore, beyond which the water rapidly deepens, so that the thousand-fathom line is reached only a short distance away.

There are only two places where an anchorage can be effected, and the interior of the island can be reached with safety. Chatham Bay, which lies on the north side, affords the best anchorage for vessels; since the waters are more quiet on this side of the island, and the sand beach at the end of the bay affords a good landing-place for boats. A small stream of water enters at the head of the bay, and, from the different dates cut in the rocks about the mouth of this stream, one would judge that it was often visited by vessels during the early part of the last century. On either side of this bay, east and west, there are tall cliffs heavily covered with tropical vegetation. Wafer Bay, on the northwest side of the island, is more exposed, and is subject at times to heavy swells which render anchorage less safe there than in Chatham Bay. With

the exception of these two places and Dampier Head, on the southeast side of the island, the remainder of the shore is made up of tall cliffs, some of which must be a thousand or more feet in height, over the tops of which numerous waterfalls come tumbling down into the sea. Ten of these waterfalls were counted between Lionel Head and Berthaume Point, within a distance of less than a mile, while circumnavigating the island in a small boat.

The settlement is located at Wafer Bay, where Captain August Gissler resides with his wife and a number of laborers. Several corrugated iron houses have been built there, and a small tract of land has been put under cultivation, in which a considerable number of domesticated plants and tropical fruits are grown. For some years past Captain Gissler has been in search of treasure which is supposed to have been buried on this island during the early part of the last century. Some portions of the treasure are reported to have been found. Captain Gissler is the duly appointed governor of the island, and is visited periodically by the Costa Rican gunboat to bring supplies and mail; but as the island lies out of the general track of both sailing vessels and steamers, it is seldom visited by other vessels. At the time of our visit the gunboat had not been out for some months, and in consequence some of the supplies had begun to run low.

The sides of the mountain rise abruptly to a cone, which lies toward the west side of the island, about a mile and three-quarters from the settlement at Wafer Bay. Alternating ridges and deep canyons cover the mountain sides, rendering traveling almost impossible except along the tops of the ridges and along the beds of streams. According to Captain Gissler, a single ridge can be followed from the base to the top of the mountain, the ridges probably representing ancient lava-flows. Unfortunately none of the members of the party visited the top of the mountain, although an attempt was made to do so by following up an old trail. The trail had been made several years before, and as it had not been much used since, it had become heavily overgrown with vegetation, and could not be followed beyond 650 feet elevation. We could get very little information about the interior of the island, especially about the eastern part of it, which has never been visited so far as is

known. A fairly good view of this part of the island was obtained from the top of a cliff at Chatham Bay, and it appeared to be made up of a broad table-land heavily covered with vegetation, as are the remaining portions of the island.

Rock-exposures occur along the banks of streams and along the sides of perpendicular cliffs. So far as could be observed, the rocks are basaltic in character. Columns of basalt occur frequently near sea-level, and caverns of considerable depth have been formed in many places by the action of the waves. The soil is composed for the most part of a sticky yellow clay and vegetable mold. From the more exposed places the mold has been washed off, leaving the clay bare. On the steep sides of the mountain erosion is rapid. In the small valleys one often encounters large forest trees which have been dislodged from the steep hillsides above by the washing away of soil from the roots to such an extent that they could no longer maintain their position. Land-slides are rather frequent, and when they occur, large quantities of earth and boulders are brought down along with the vegetation which covers the area. After a land-slide *Ipomoea cathartica* seems to be one of the first plants to invade the denuded area, followed by *Hibiscus tiliaceus*.

The island lies in the moist tropical belt, and has a large amount of rainfall, the exact amount of which is not known, but it probably amounts to several feet per year. May, June, and July are said to be the rainiest months, and January, February, and March the driest. It rained eight out of the eleven days we were on the island, and some of the rains during this time were much harder than those which occur in more temperate regions. According to Captain Gissler the temperature ranges from 68° to 92° F.

Halophytic plants are very few in number, possibly because of the precipitous nature of the shores in most places. *Ipomoea Pes-caprae* is the most pronounced halophyte, and it occurs only to a limited extent on the sand beaches at Wafer Bay. *Hibiscus tiliaceus* forms small groves near the beach in a few places; and *Clusia rosea* often forms dense thickets along the sides of the cliffs some distance above the water, sending down absorbing roots into the sea. At several places near the shore there are small groves of *Cocos nucifera*, the nuts of

which are used to make oil for lighting purposes when the gunboat from Costa Rica delays its periodic trips too long. There are no mangroves, possibly because of the absence of quiet bays and lagoons.

The interior of the island is covered for the most part with rain-forests, in which the vegetation is usually so dense that even at midday, with the sun shining, the light is almost as diffuse as at twilight. In such places there is an intense struggle among plants to gain the light—in consequence of which both epiphytes and lianes are very abundant in individuals, if not in species. The following list includes the species in the collection which are either epiphytes or lianes :

Anthurium scandens
Ipomoea cathartica
Lycopodium linifolium
Oleandra nodosa
Philodendron sp.
Selaginella Galeottii
Tassadia colubrina
Tillandsia sp.
Trichomanes capillaceum.

In addition to the above, there are several lianes which are in a sterile condition, so that even their generic relations cannot be determined. One of these is the most important liane on the island, extending in rope-like masses from tree to tree, often supporting hanging baskets of *Tillandsias* and other epiphytes.

Unfortunately specimens of the large forest trees are but poorly represented in the collection, because of the fact that the most of the forest trees tower a hundred or more feet above the ground. Since the foliage is almost invariably at the top, specimens could not be obtained without cutting down the trees—which was too much of an undertaking. I used to look up longingly at the tops of these trees, wishing that I could obtain specimens; but I have since learned that it is the common experience of botanists to be unable to obtain specimens of the forest trees while collecting in tropical rain-forests.

Besides the trees of *Hibiscus* and *Clusia*, mentioned above, there is at least one species of *Cecropia* which commonly

occurs along the faces of almost perpendicular cliffs, the roots being able to hold on to a mere crevice or shelf of rock, while the trunks grow up parallel with the wall of the cliff. There is also a species of palm which grows mostly above 400 feet elevation. Some specimens of this were collected lower down, but they are in a sterile condition. At least two species of *Ficus* occur here, one of which forms banyan trees of some size. The largest, and probably the most important tree from an economic standpoint, is one which bears the common name of "iron wood" according to Captain Gissler, who says that there are trees on the island so large that timbers 3×3×60 feet could be cut from them. The wood of this tree is dark brown in color and very hard.

Underneath the trees there is usually a dense growth of bushes, so thick in most places that traveling through them is extremely difficult. In fact we found that the easiest way to get into the interior of the island was to follow up the beds of the larger streams, and occasionally make short excursions off to the side. The most common bushes are; *Eugenia pacifica*, *Clidemia hirta*, *C. umbonata*, *Miconia dodecandra*, and *Clibadium acuminatum*; three of which belong to *Melastomaceae*, and are the most abundant. Ferns also occur abundantly, forming a very important element of the undergrowth. Extensive brakes are formed by *Nephrolepis biserrata*, especially where the large vegetation is more or less open. The moist banks along the sides of the streams are usually heavily covered with ferns, those which occur in such places being: *Adiantum petiolatum*, *Asplenium cristatum*, *Ceropteris calomelanos*, *Hymenophyllum* sp., *Polybotrya cervina*, *Polypodium aureum*, *Trichomanes crispum*, and *T. elegans*. *Alsophila armata* is the only tree-fern found on the island.

Filices are by far the largest family represented in the collection, twenty out of the seventy-seven species of vascular plants collected belonging to it. Of the remaining families of vascular plants there are none that contain more than five species, and the majority are represented by but one or two.

Endemic species are included in the following: *Chloris paniculata*, *Kyllinga nudiceps*, *Cecropia Pittieri*, *Eugenia pacifica*, *Ossæa macrophylla*, *Ardisia cuspidata*, *Bertiera angustifolia*, and *Clibadium acuminatum*.

On comparing the above with the number of endemic species found on the Galapagos Islands, one is at once struck with the small number of endemic species found on this island; and while the entire flora is not recorded in this paper, it is very likely that the number of species omitted is not large. It is of course unsafe to draw any very definite conclusions from incomplete data, yet it is safe to say that the per cent of endemic species on the Galapagos Islands is very much larger than on Cocos Island. It is interesting to note that but 8.69% of the species mentioned in this paper are endemic, while in the Galapagos Islands 40.9% are endemic. There is also an evident wide divergence in the total number of species found on the two, the Galapagos flora containing 682 species, while the Cocos flora very likely contains but little if at all over a hundred species.

The wide divergence between the flora of the Galapagos Islands and that of Cocos Island, has been mentioned by authors who have written on these floras in the past. The following is a list of the species found on Cocos Island which are also found on the Galapagos Islands:

Acrostichum aureum
Adiantum petiolatum
Asplenium cristatum
Asplenium myriophyllum
Dryopteris parasitica
Nephrolepis biserrata
Nephrolepis pectinata
Polypodium aureum
Polypodium lanceolatum
Polypodium Phyllitides
Polystichum adiantiforme
Digitaria sanguinalis
Eleusine indica
Paspalum conjugatum
Paspalum distichum
Setaria setosa
Commelina nudiflora
Fleurya aestuans

*Anona cherimolia**
Anona glabra
Caesalpinia bonducella
Euphorbia pilulifera
*Ricinus communis**
Hibiscus tiliaceus
Ipomoea Bona-nox
Ipomoea Pes-caprae
*Coffea arabica**

From the above presentation it can be seen that the species common to the two groups of islands are for the most part those of rather wide distribution, and owing to the relatively small size of most of them, the general appearance and make-up of the two floras is but little influenced by them. The species which make up the bulk of the vegetation, especially the larger vegetation, are totally different on the two groups of islands—a fact which may have some significance.

In a paper written some years ago by Dr. George Baur,† an attempt was made to establish a former land-connection between the Galapagos Islands and the American continent, the connection presumably having been somewhere in the Mexican region. The improbability of such a connection has already been shown,‡ and it seems that the great difference in the floras of Cocos and the Galapagos islands strongly opposes Dr. Baur's view.

If there has ever been a land-mass connecting the Galapagos Islands with the mainland of North America, it must evidently have included the Cocos Island region, since its position is such that no considerable land-mass could have existed in this part of the ocean without including it. While the climatic conditions on the lower parts of the islands of the Galapagos group are entirely different from that of Cocos Island, being dry in one and moist in the other, the middle and upper portions of the higher islands of the Galapagos are moist, and capable, in places at least, of supporting fully as mesophytic vegetation as is Cocos—a fact which is evinced by the presence of eleven ferns common to the two. A former land-

* Probably introduced through cultivation into both the Galapagos Archipelago and Cocos Island.

† American Naturalist, v. 25, 310 (1911).

‡ Stewart. Proc. Calif. Acad. Sci. 4th Ser. v. 1, No. 2, pp. 233-239.

connection between the two groups of islands should have left a much larger number of species common to the two than is actually found.

The flora of Cocos, like that of the Galapagos Islands, is distinctly that of an oceanic island. The relatively large number of ferns, the much smaller number of species in the remaining families, and the total number of species found on the island lend support to this view. The flora is probably of much more recent origin than is that of the Galapagos Islands. While the island lies nearer to the mainland by nearly three hundred miles, where presumably the various agents that disseminate seeds would work to at least as good advantage as in the Galapagos Islands, yet the number of species represented is probably not more than one-sixth as great. It seems possible that the time that has elapsed since conditions on the island were suitable for the growth of higher vegetation has not been sufficient to stock the island by the slow process of seed dissemination, over considerable areas of water, with as many species as it is capable of supporting. The small number of endemic species on the island might also point to a relatively recent origin of its flora.

The following are the species collected on the island by the author:

FILICES

Acrostichum L.

A. aureum L. Sp. Pl. 1069 (1753): very abundant along the stream leading into Wafer Bay and on the hillsides up to 125 ft. It grows in large bunches 6-8 ft. high and with 30 or more fronds to a bunch, (No. 225). Further distr. general in tropical regions.

Adiantum L.

A. petiolatum Desv. Berl. Mag. V. 326 (1811): in crevices or rocks on the banks of the stream leading into Wafer Bay, (No. 226). Further distr. Mex., W. Ind., S. Am.

Alsophila R. Br.

A. armata (Sw.) Pr. Tent. 62 (1836). *Polypodium armatum* Sw. Prod. 134 (1788): very abundant on the banks of

the streams and on the hillsides surrounding both Chatham and Wafer Bays. It forms trees 8-15 ft. in height, and is apparently the only tree-fern on the island, (No. 227). Further distr. Mex., W. Ind., S. Am.

Asplenium L.

A. cristatum Lam. Encycl. II. 310 (1786): common on wet rocks on the side of a perpendicular cliff near Chatham Bay, (No. 228). Further distr. Mex., W. Ind., S. Am., Old World.

Ceropteris Link.

C. calomelanos (L.) Und. Bull. Torr. Cl. XXIX. 632 (1902). *Acrostichum calomelanos* L. Sp. Pl. 1072 (1753): common on the sides of moist banks on the stream leading into Chatham Bay, (No. 230). Further distr. W. Ind., S. Am., Africa.

Dryopteris Adans.

D. parasitica (L.) O. Ktze. Rev. Gen. II. 811 (1891). *Polypodium parasiticum* L. Sp. Pl. 1090 (1753): abundant at 600 ft. The specimens are sterile and doubtful, (Nos. 231-32). Further distr. Mex., W. Ind., S. Am., Old World.

Elaphoglossum Schott.

E. apodum (Klf.) Schott, Gen. ad. t. 14 (1834). *Acrostichum apodum* Klf. Enum. 59 (1824): occasional specimens were found growing on rotten logs on the banks of the stream leading into Wafer Bay, (No. 229). Further distr. W. Ind., northern S. Am.

Hymenophyllum Sm.

H. sp: on the side of a wet perpendicular cliff near Wafer Bay. The specimen is sterile, (No. 233).

Nephrolepis Schott.

N. biserrata (Sw.) Schott, Gen. Fil. ad. t. 3 (1834). *Aspidium biserratum* Sw. Schrad. Jour. 1800. II. 32 (1801): one of the most abundant ferns on the island. It grows in great profusion on the hills surrounding Chatham Bay, in places

forming dense brakes 6-8 ft. high. It is less abundant around Wafer Bay and apparently does not occur below 125 ft. (Nos. 234-37). Further distr. Mex., W. Ind., S. Am., Old World.

N. pectinata (Willd.) Schott, Gen. Fil. ad. t. 3 (1834). *Aspidium pectinatum* Willd. Sp. V. 223 (1810): abundant in vegetable mold in moist shady places, (No. 238). Further distr. Mex., W. Ind., S. Am., Old World.

Oleandra Cav.

O. nodosa (Willd.) Pr. Tent. 78 (1836). *Aspidium nodosum* Willd. Sp. V. 211 (1810): growing very abundantly on the trunks of trees see Plate XXXII, (No. 239). Further distr. Mex. (Cent. Am.), W. Ind., N. S. Am.

Polybotrya H. & B.

P. cervina (L.) Klf. Enum. 55 (1824). *Osmunda cervina* L. Sp. Pl. 1065 (1753): abundant in woodland and on the banks of the stream leading into Wafer Bay, (No. 240). Further distr. Mex., W. Ind., N. S. Am.

Polypodium L.

P. aureum L. Sp. Pl. 1087 (1753): common on the sides of moist banks near Chatham Bay, (No. 245). Widely distributed.

P. Phyllitides L. Sp. Pl. 1083 (1753): common, (Nos. 243-44). Further distr. S. U. S., Mex., W. Ind., S. Am.

Polystichum Roth.

P. adiantiforme (Forst.) J. Sm. Hist. Fil. 220 (1875). *Polypodium adiantiforme* Forst, Prod. 82 (1786). *Asplenium coriaceum* Sw. Syn. Fil. 57 (1806): specimens are sterile and doubtful, (Nos. 241-42). Further distr. W. Ind., S. Am., Old World.

Trichomanes L.

T. capillaceum L. Sp. Pl. 1099 (1753): fairly abundant on the trunks of trees at 600 ft. (No. 246). Further distr. Mex., W. Ind., S. Am.

T. crispum L. Sp. Pl. 1097 (1753) : common on wet shady banks near Wafer Bay, (Nos. 247-49). Further distr. Mex., W. Ind., S. Am., Africa.

T. elegans Rich. Act. Soc. Hist. Nat. Paris, I. 114 (1792) : rare on wet shady banks, (No. 251). Further distr. W. Ind., S. Am.

T. radicans Sw. Schrad. Jour. 1800, II. 97 (1801) : occasional on rotten tree-trunks near Wafer Bay, (Nos. 252-54). Widely distributed in tropical regions.

Filices sp.: specimen is sterile and indeterminate, (No. 250).

LYCOPODIACEÆ

Lycopodium L.

L. linifolium L. Sp. Pl. 1100 (1753) : common on the trunks of trees and on the sides of moist banks below 600 ft. (Nos. 255-58). Further distr. Mex., W. Ind., S. Am.

Selaginella Beauv.

S. Galeottii Spring, Monog. Lycopod. 220 (1842-49) : common on the banana trees in gardens at Wafer Bay, (No. 259). Further distr. Mex., N. S. Am.

GRAMINEÆ

Chloris Sw.

C. paniculata Schribner, in Rob. Fl. Gal. Isl. Proc. Am. Acad. XXXVIII. No. 4, 262 (1902) : grows abundantly on exposed rocky cliffs near the shore, and is also common on the small islets in the immediate vicinity of the main island, (No. 260). Endemic.

Digitaria Scop.

D. sanguinalis (L.) Scop. Fl. Carn. ed. II. 1, 52 (1772). *Panicum sanguinale* L. Sp. Pl. 57 (1753) : in crevices of the rocks along the stream leading into Wafer Bay and in cultivated ground, (Nos. 261-62). Widely distributed.

Paspalum L.

P. conjugatum Berg. Act. Helv. VII. 129, t. 8 (1772): common in cultivated ground around Wafer Bay, (No. 263). Further distr. Mex., W. Ind., S. Am., Old World.

Setaria Beauv.

S. setosa (Sw.) Beauv. Agrost. 51 (1812). *Panicum setosum* Sw. Prod. 22 (1788): common in cultivated ground near Wafer Bay, (No. 264). Further distribution, tropical regions.

CYPERACEAE

Calyptocarya Nees.

C. longifolia (Rudg.) Kunth, Enum. II. 365 (1837). *Schoenus longifolius* Rudg. Pl. Gui. 14, t. 16 (1805). *Calyptocarya palmetto* Nees, Cyp. Bras. 195 (1842): abundant on the banks of the stream near Wafer Bay, (No. 265). Further distr. Panama, W. Ind., N. S. Am.

Cyperus L.

C. prolixus HBK. Nov. Gen. & Sp. I. 206 (1815): abundant in the low flat area near Wafer Bay. The specimen is immature and somewhat doubtful as to species, (No. 266). Further distr. Mex., N. S. Am.

C. sphactelatus Rottb. Descr. 26 (1786): in low ground near Wafer Bay, (Nos. 267-69). Further distr. W. Ind., N. S. Am.

Hypolytrum Rich.

H. nicaraguenses Liebm. in Vedinsk. Selsk. Skr. V. ii. 235 (1851): common in large bunches in woodland and on the banks of the stream leading into Wafer Bay. Also found around the top of the island at 2788 ft. according to Capt. Gissler, (Nos. 270-71). Further distr. Nicaragua.

Kyllinga Rottb.

K. nudiceps C. B. Clark, in Rob. Fl. Gal. Isl. Proc. Am. Acad. XXXVIII. 262 (1902): fairly common in crevices of the rocks on sides of cliffs, (No. 272). Endemic.

PALMAE

Cocos L.

C. nucifera L. Sp. Pl. 1188 (1753): very abundant at various places along the shores of the island. It is especially abundant at Dampier Head on the southeast side of the island. No specimens were taken for botanical purposes. Widely distributed.

Palmae sp.: an undetermined species of palm occurring quite abundantly on the hillsides above both Chatham and Wafer bays. It seems to be most abundant above 400 ft. (Nos. 273-74).

ARACEAE

Anthurium Schott.

A. scandens (Aubl.) Engl. in Mart. Fl. Bras. III. p. 2, 78 (1878-82). *Dracontium scandens* Aubl. Pl. Gui. II. 836 (1775): common on trees at 600 ft. (No. 279). Further distr. Cent. Am.

Philodendron Schott.

P. sp.: occasional, covering bushes and small trees on the banks of the stream near Wafer Bay. The specimens are sterile, (No. 280).

Spathophyllum Schott.

S. Wendlandii Schott, in Ostr. Bot. Zeitschr. VIII. 179 (1858): common in densely shaded places on the banks of streams near sea-level, occasional at 600 ft. (Nos. 275-78). Further distr. Cent. Am.

BROMELIACEAE

Tillandsia L.

T. sp.: very abundant on the trunks and branches of trees all over the island. The fruiting specimen is fragmentary, but seems to be close to *T. utriculata* L., differing in the broader leaves and the shorter pedicels of the flowers. 286-87. A specimen doubtfully labeled *Catopsis aloides* Bak. in the Gray Herbarium, which was collected on this island by Snodgrass & Heller of the Hopkins Stanford Expedition, is probably the same.

COMMELINACEAE

Commelina Plum.

C. nudiflora L. Sp. Pl. 41 (1753): common on the bank of a stream near Chatham Bay, (No. 288). Widely distributed in tropical regions.

PIPERACEAE

Peperomia R. & P.

P. nigropunctata Miq. Syst. Pip. 188 (1840): occasional on moist rotten logs, (No. 289). Further distr. Martinique Isl.

MORACEAE

Ficus L.

F. tecolutensis (Liebm.) Miq. ? in Ann. Mus. Bot. Ludg. III. 299, n. 64 (1867). *Urostigma tecolutense* Liebm. K. Dansk. Vidensk. series 5, II. 324, [reprint, 40 (1851)]: the specimen is sterile and doubtful as to species, (No. 290). Further distr. S. Mex.

F. sp.: a species of *Ficus* forming large banyan trees occurs on the sides of the hills above Chatham Bay. No specimens were secured of this species.

URTICACEAE

Cecropia L.

C. Pittieri Robinson, nov. sp. "arborea; ramis 3-4 cm. crassis cavis septatis; foliis orbicularibus magnis 5 dm. diametro petatis breviter 10-lobatis supra sparse pilosis glabratis viridibus subtus albidis valde reticulatis nervis patente hirsutis; lobis brevibus latisque semiorbicularibus margine undulatis apice rotundatis vel breviter acuminatis sinibus rotundatis; petiolo 4 dm. longo 1 cm. diametro tereti albido-arachnoideo basi incrassato sordide hirsuto; stipulis oblongo-lanceolatis acutis 1.6 dm. longis 6 cm. latis utrinque hirsutis margine integerrima tenuiore glabriuscula excepta; spatheis masculis teretibus apice longissime attenuatis 1.4 dm. longis extus griseo-pubescentibus, pedunculo robusto 8 cm. longo; spicis masculis ca. 19 sessilibus 1 dm. longis 3 mm. crassis. A true characteristic of the lower

region on the east and north coast of the island, alt. 10-150 m., Pittier, No. 16237 (hb. Gr.). This species like *C. peltata* is distinguished from most of its congeners by its shallowly lobed leaves, the sinuses penetrating only a fourth of the distance from the margin to the center of the leaf. From *C. peltata* L. of the West Indies and South America it differs as follows: Its petioles, instead of having a close tawny or at least sordid tomentum as in that species, are covered by a white deciduous arachnoid wool. The upper surface of the leaf is not at all scabrous, and the nerves beneath are very coarsely hirsute. The color of the lower surface of the leaf also is decidedly paler than in any specimen of *C. peltata* at hand. From *C. obtusa* it differs in the acumination of the middle leaf-lobes." The specimens secured on this island have younger leaves than the type specimen; (No. 291). Endemic.

Fleurya Gaud.

F. aestuans Gaud. in Freyc. Voy. Bot. 497 (1826): common in cultivated ground around Wafer Bay, (Nos. 292-93). Further distr. Mex., W. Ind., S. Am.

PHYTOLACCACEAE

Phytolacca L.

P. isocandra L. Sp. Pl. 631 (1753): occasional on the banks of the stream near Wafer Bay, (No. 294). Further distr. Mex., W. Ind., N. S. Am.

ANONACEAE

Anona L.

A. cherimolia Mill. Gard. Dict. ed. VIII. n. 5 (1768): trees in gardens and probably introduced, (No. 295). Further distr. Mex., W. Ind., S. Am.

A. glabra L. Sp. Pl. 537 (1753): a few low bushes of this species were found growing on the beach at Dampier Head. Further distr. S. U. S., W. Ind.

LEGUMINOSAE

Cassia L.

C. reticulata Willd. Enum. Hort. Berol. 443 (1809): forms occasional clumps of bushes 6-8 ft. high near the beach at Chatham Bay, (No. 296). Further distr. Mex., N. S. Am.

Caesalpinia L.

C. bonducella (L.) Fleming in As. Res. XI. 159 (1810). *Guilandina bonducella* L. Sp. Pl. ed. 2, 545 (1763): occasional bushes 6-8 ft. high near the beach at Wafer Bay (No. 297). Further distr. general in warm countries.

Desmodium Desv.

D. sp.: common at Wafer Bay and at Dampier Head. The specimens are sterile, (No. 298).

Leguminosaea sp.: a tendril-bearing vine, sterile and indeterminate, (No. 299).

EUPHORBIACEAE

Acalypha L.

A. bisetosa Bert. acc. to Spreng. Syst. III. 879 (1826): occasional bushes about 8 ft. high, (No. 300). Further distr. W. Ind., N. S. Am.

MALVACEAE

Hibiscus L.

H. tiliaceus L. Sp. Pl. 694 (1753): common trees near the shore and on the sides of the hills. The specimens found growing on the shore were usually low and spreading, while those on the hillsides were tall and straight. According to Capt. Gissler, the wood of this tree makes excellent paper pulp, and at the time our party visited the island, he was trying to interest parties in this in order to start a pulp-industry on the island, (Nos. 301-04). Widely distributed in tropical regions.

BOMBACEAE

Ochroma Sw.

O. lagopus Sw. Prod. 98 (1788). *Bombax pyramidale* Cav. Dis. V. t. 153 (1788): common trees, (No. 281). Further distr. Mex., W. Ind., S. Am.

HYPERICACEAE

Clusia L.

C. rosea Jacq. Enum. 34 (1760): grows very abundantly on the rocks above the sea, forming dense thickets of low trees. It often puts out numerous absorbing roots which extend down into the sea-water. It also occurs abundantly on both Conic and Nuez Islands, from the last of which the specimens were taken, (Nos. 282-83). Further distr. Panama, W. Ind., N. S. Am.

COMBRETACEAE

Terminalia L.

T. Catappa L. Mont. II. 519 (1771): a few large trees of this species occur on the flat area just back of the beach at Wafer Bay. It is probably introduced, (No. 331). Widely distributed.

MYRTACEAE

Eugenia L.

E. pacifica Benth. Bot. Sulph. 98 (1844): low bushes on the banks of streams, (No. 284). Endemic.

MELASTOMACEAE

Clidemia D. Don.

C. hirta (L.) D. Don. in Mem. Wernerian Soc. IV. 309 (1822). *Melastoma hirta* L. Sp. Pl. 390 (1753): common bushes and small trees in woodland at 600 ft. (No. 285). Further distr. Mex., W. Ind., S. Am.

C. umbonata Sch. & Mart. in DC. Prod. III. 158 (1828): common bushes in woodland, (No. 305). Further distr. N. S. Am.

Conostegia D. Don.

C. lasiopoda Benth. Bot. Sulph. 96 (1844): small trees, abundant, (No. 306). Endemic.

Miconia Ruiz. & Pav.

M. dodecandra (Desv.) Cogn. in Mart. Fl. Bras. XIV. pt. 4, 243 (1887). *Melastoma dodecandra* Desv. in Lam. Encyc. IV. 46 (1796): bushes abundant in woodland around Wafer Bay, (No. 307). Further distr. Mex., W. Ind., N. S. Am.

Ossaea DC.

O. macrophylla Cogn. D.C Mon. VII. 1064 (1891): small trees common at 600 ft. (No. 308). Endemic.

ONAGRACEAE

Jussieua L.

J. linifolia Vahl. Ecol. Am. II. 32 (1798): common among rocks on the side of a cliff near Chatham Bay, (No. 309). Widely distributed in tropical regions.

MYRSINACEAE

Ardisia Sw.

A. cuspidata Benth. Bot. Sulph. 123 (1844): occasional bushes (Nos. 310-12). Endemic.

A. humilis Vahl.? Symb. III. 40 (1794): occasional bushes at 600 ft. (No. 313). The specific identity of this specimen is doubtful, but it resembles fruiting specimens of this species in the Gray Herbarium. Further distr. East Indies.

Rapanea Aubl.

R. Guianensis Aubl. Pl. Gui. 121 (1775): bushes about 8 ft. high on the banks of the stream near Wafer Bay, (No. 320). Further distr. Mex., W. Ind., N. S. Am.

ASCLEPIADACEAE

Tassadia Decne.

T. Colubrina Decne. DC. Prod. VIII. 579 (1844): common at 650 ft. (No. 321). Further distr. Brazil.

CONVOLVULACEAE

Ipomoea L.

I. cathartica Poir. Dict. Supl. IV. 633 (1816): common on open hillsides, often covering the ground and vegetation with a dense mass of vines, (Nos. 322-23). Further distr. S. U. S., W. Ind., N. S. Am.

I. Pes-caprae (L.) Sweet, Hort. Sub. Lond. 35 (1818). *Convolvulus Pes-caprae* L. Sp. Pl. 159 (1753): common on the beach at Wafer Bay, (No. 324). Widely distributed on tropical shores.

RUBIACEAE

Bertiera Blum.

B. angustifolia Benth. Bot. Sulph. 103 (1844): bushes 6-8 ft. high at 300 ft. (No. 325). Endemic.

Coffea L.

C. arabica L. Sp. Pl. 172 (1753): evidently an introduced species. Widely distributed in tropical regions through cultivation.

Rustia Klotz.

R. occidentalis (Benth.) Hemsl. Biolog. Cent. Am. Bot. II. 14 (1881-82). *Exostemma occidentale* Benth. Bot. Sulph. 104 (1844): occasional bushes, (No. 315). Further distr. Cent. Am., N. S. Am.

Spermacoce L.

S. ocymoides Burm Fl. Ind. 34 (1768): common in open grassy places on the banks of the stream near Wafer Bay, (Nos. 316-17). Widely distributed in tropical regions.

VERBENACEAE

Cornutia L.

C. grandifolia (Ch. & Schl.) Schau. in DC. Prod. XI. 682 (1847). *Hosta grandifolia* Ch. & Sch. Linn. V. 97 (1830): bushes about 8 ft. high on the sides of cliffs and on the banks of the stream near Wafer Bay, (No. 318). Further distr. S. Mex.

COMPOSITAE

Blainvillea Cass.

B. biaristata DC. Prod. V. 492 (1836): common in cultivated ground, (No. 319). Further distr. Brazil.

Clibadium L.

C. acuminatum Benth. Bot. Sulph. 114 (1844): common bushes near Wafer Bay, (No. 326). Endemic.

Rolandra Rottb.

R. argentea Rottb. Coll. Havn. II. 258 (1775): common on the sides of the cliffs near Chatham Bay, (No. 327). Further distr. Panama, W. Ind., N. S. Am.

Wedelia Jacq.

W. paludosa DC. Prod. V. 538 (1836): very abundant in open places on the sides of the hills above Chatham Bay, sometimes covering the ground with a dense mass of vegetation 2-3 ft. high to the exclusion of almost all other plants. It also occurs to some extent at Wafer Bay, occasional specimens being seen at 600 ft. in this region, (No. 328). Further distr. Cent. Am., N. S. Am.

The following species of mosses occurring in the collection were identified by Dr. W. G. Farlow:

- Pilotrichum bipinnatum* (Sch.) Brid.
- Hyphnella pallescens* (Hook) Jaej.
- Syrrhopodon rigidus* Hook. and Grev.
- Octoblepharum albidum* Hedw.
- Rhyzogenium spiniforme* (L.) Bruch.

The following vascular plants are mentioned by Robinson,* but were not included in the collection:

- Acrostichum caudatum* Hook.
- Adiantum intermedium* Sw.
- Asplenium rhizophyllum* Kunze
- Dicksonia cicutaria* Sw.
- Polypodium chnoodes* Spreng.
- Polypodium lanceolatum* L.
- Trichomanes pyxidiferum* L.
- Lycopodium mollicomum* Mart.
- Selaginella stenophylla* A. Br.
- Eleusine indica* Gaertn.
- Paspalum distichum* L.
- Paspalum platycaule* Poir.
- Euphorbia pilulifera* L.
- Ricinus communis* L.
- Ipomoea Bona-nox* L.

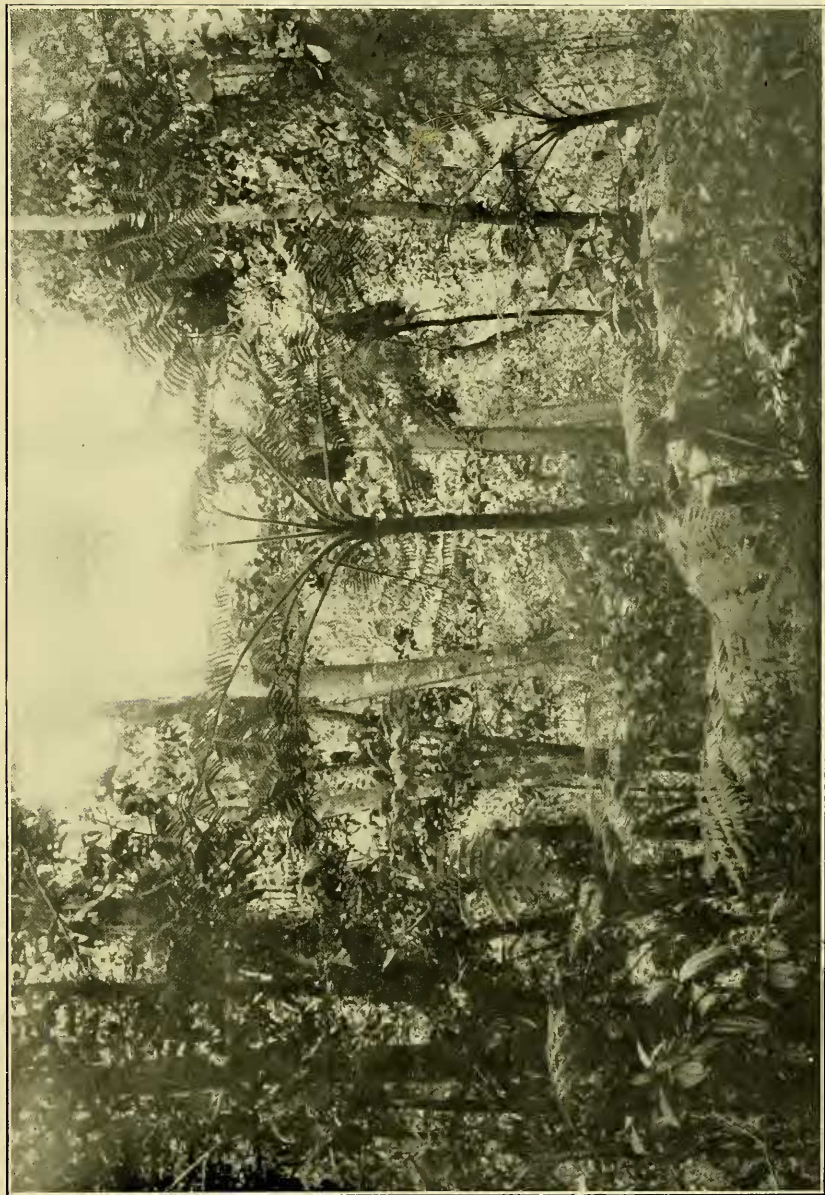
UNIVERSITY OF WISCONSIN,
July 6, 1911.

* Flora of the Galapagos Islands. Proceedings of the American Academy of Arts and Sciences, v. 38, No. 4, 241, 261-63 (1902).



EXPLANATION OF PLATE XXXI

An opening in the forest, showing *Alsophila armata* in the center and a dense growth of ferns and bushes.



EXPLANATION OF PLATE XXXII

Trees along the bank of the stream leading into Wafer Bay, heavily covered with epiphytes.

